WEIGHTED-COVARIANCE FACTOR DECOMPOSITION OF VARMA MODELS APPLIED

TO FORECASTING QUARTERLY U.S. GDP AT MONTHLY INTERVALS[*]

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ABSTRACT

We develop and apply a method, called weighted-covariance factor decomposition (WCD), for reducing large estimated vector autoregressive moving-average (VARMA) data models of many "important" and "unimportant" variables to smaller VARMA-factor models of "important" variables and significant factors. WCD has four particularly notable features, compared to frequently used principal components decomposition, for developing parsimonious dynamic models: (1) WCD reduces larger VARMA-data models of "important" and "unimportant" variables to smaller VARMA-factor models of "important" variables, while still accounting for all significant covariances between "important" and "unimportant" variables; (2) WCD allows any mixture of stationary and nonstationary variables; (3) WCD produces factors, which can be used to estimate VARMA-factor models, but more directly reduces VARMA-data models to VARMA-factor models; and, (4) WCD leads to a model-based asymptotic statistical test for the number of significant factors. We illustrate WCD with U.S. monthly indicators (4 coincident, 10 leading) and quarterly real GDP. We estimate 4 monthly VARMA-data models of 5 and 11 variables, in log and percentage-growth form; we apply WCD to the 4 data models; we test each data model for the number of significant factors; we reduce each data model to a significant-factor model; and, we use the data and factor models to compute out-of-sample monthly GDP forecasts and evaluate their accuracy. The application's main conclusion is that WCD can reduce moderately large VARMA-data models of "important" GDP and up to 10 "unimportant" indicators to small univariate-ARMA-factor models of GDP which forecast GDP almost as accurately as the larger data models.